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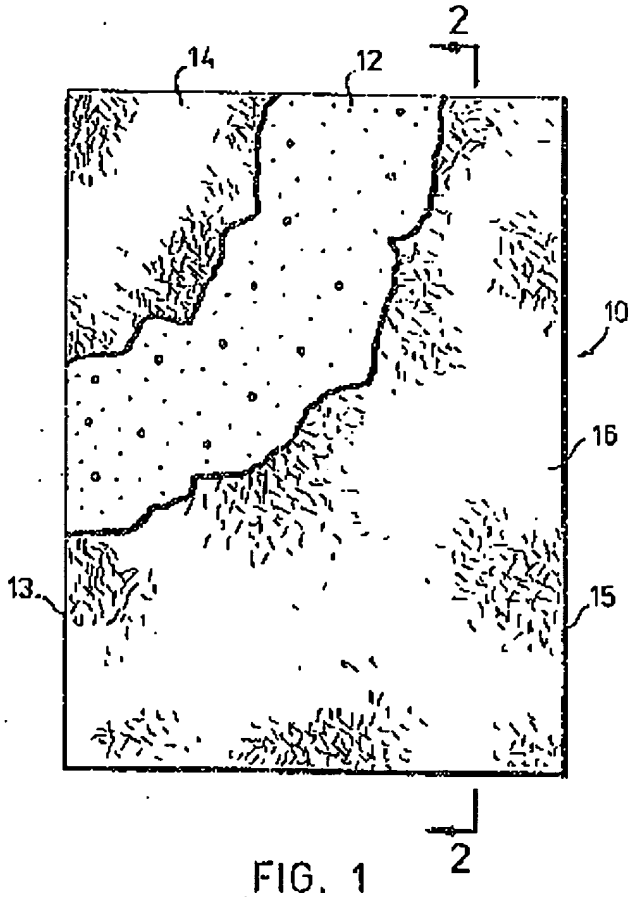

FIG. 1

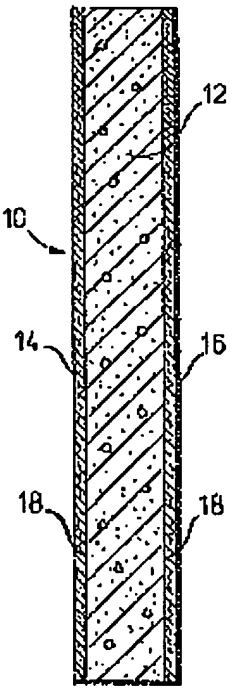

FIG. 2

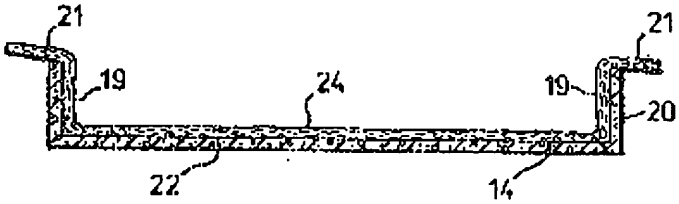

FIG. 3

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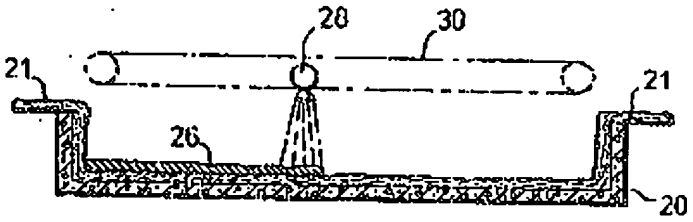

FIG. 4

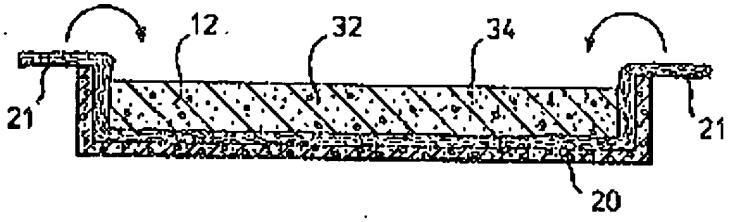

FIG. 5

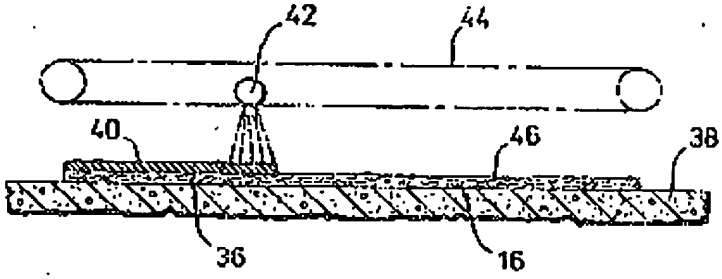

FIG. 6

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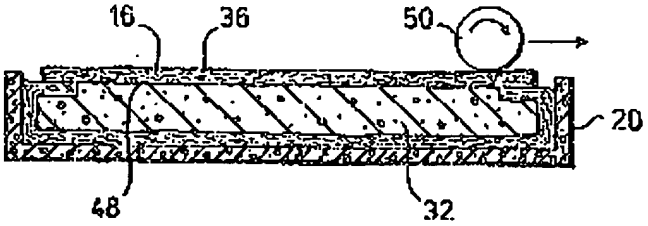

FIG. 7

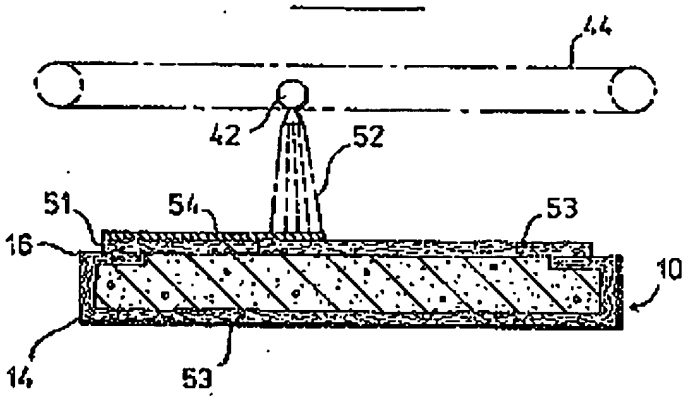

FIG. 8

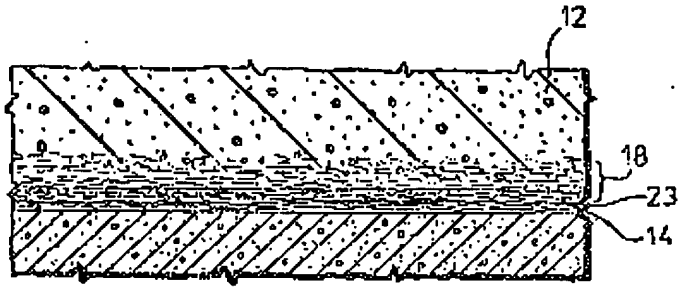

FIG. 9

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Consommation et Corporations Canada
Bureau des brevets
Ottawa, Canada
K1A 0C9

Consumer and Corporate Affairs Canada
Patent Office

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(22) 1989/12/20
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(51) INTL.CL.[5] B28B-19/00; B32B-13/04

(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Manufacture of Cement Base Products Using Surface Reinforcement

(72) Sulkiewicz, Jan A. - Canada ;

(73) Same as inventor

(57) 30 Claims

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ABSTRACT

A process is disclosed for manufacturing concrete products such as panels suitable for building construction. A surface reinforcing layer of porous material is arranged in a concrete form. This material comprises a fabric or moisture-resistant paper and is resistant to alkaline conditions. An inner surface thereof is coated with a polymer so that the applied polymer penetrates the layer. A cementitious composition is cast over and onto the layer of material in the form. The composition has a consistency to enable partial substantial penetration of the layer of material and the amount thereof is sufficient that a major portion lies on top of the layer. A sheet of porous material that is resistant to alkaline conditions is coated on one surface with polymer and this sheet is placed over the exposed surface of the cast composition so that the coated surface lies against the cementitious composition and enables the latter to penetrate partially the sheet. The formed product is then cured and removed from the form.

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This invention relates to cement based products, including panels and a process for making such products.

In the construction of building walls extensive use is made of preformed panels or sheets such as fibreboard and plaster board. It is common for example in housing to use a "drywall" construction that employs a relatively low strength gypsum core and paper reinforcing layers covering both faces of the panel. After the panels are attached to suitable framing, the joints are taped, filled and smoothed in preparation for painting. The paper exterior surface is advantageous in that it not only provides a surface that is smooth in appearance but the surface is also porous enough that it provides a good bond to coatings such as paint. One difficulty with standard drywall construction is that it is not suitable for wet or moist conditions. In addition drywall is not particulary strong and durable and can be damaged and punctured with relative ease compared to, for example, a concrete surface.

The advantage of a concrete product is that the ingredients for concrete have a low cost and, if a concrete product is properly prepared and cured, it will resist water damage. Thin sections of concrete

must generallly however be reinforced because such sections are generally brittle and will break, even under their own weight.

One known method for producing a concrete product having a precise profile or flat concrete panels includes the preparation of a suitable concrete mixture, including cement, a filler such as sand, water and additives and casting this mixture over a reinforcing mesh placed in a suitable form. The concrete is then finished and sized to the correct final dimensions following which a further reinforcing mesh is placed on the exposed surface. This mesh is embossed or pushed into the concrete mass to form the final product. Typically the openings in the reinforcing mesh measure 1 mm or more in size.

Problems have been encountered with concrete panels produced by the abovementioned method, some of which are due to the type of reinforcing mesh employed. When the mesh is made from metal wires, such wires are often subject to corrosion because they are not sufficiently protected by the concrete. This is particulary a problem with relatively thin panels because the reinforcement is not sufficiently deep in the concrete mass in such panels. On the

other hand if polymer fibers are used for the mesh, this material will burn or soften when the panel is subjected to fire or very hot conditions. Of course if the polymer does soften from the heat, it will cease to function as a reinforcement.

Another type of reinforcing mesh that is often considered for such concrete products is one made from fiber glass. However unless the glass fibers are coated to protect them, they can be damaged, and even destroyed, by the alkaline conditions produced by the cement.

Another difficulty with some of the known methods for reinforcing a concrete product such as a panel is that the reinforcements do not assist in the application of a final coating to the product or panel. Often the reinforcing material is buried beneath the surface of the concrete and therefore any coating such as paint is not applied to it. It will be appreciated that in many cases a concrete product such as a panel is intended to be painted or decorated in some fashion in order to provide a pleasing appearance. In fact, the commonly used methods for producing concrete products of this nature often increase the difficulty of applying a coating such as paint to the exposed surfaces. Usually a delaminating material such as oil is

applied to the form prior to the use thereof so that the formed product can be readily removed from the form after it has been cast. Usually some of this material remains on the product after it has been removed from the form making it very difficult to apply decorative coatings such as paint properly.

U.S. Patent No. 3,284,908 issued November 15, 1966 to P.E. Dinkel describes a panel with a low density concrete core and fiber reinforced surfaces. Each fiber layer is strongly bonded to the core by a light layer of bonding agent which penetrates the interstices in the fiber layer. The fiber layers can comprise glass fibers coated with a vinyl resin. The bonding material is at least 50% hydraulic cement and each layer of this material is substantially thinner than the core and low in voids.

More recent U.S. Patent No. 4,159,361 issued June 26, 1979 to M. Schupack describes a cement core panel which is reinforced over both major surfaces. Each reinforcing layer is positioned so that its top surface is flush with the outer surface of the core. This specification teaches that the cement material must have controlled bleed characteristics in order to ensure a tight bond. The cement material that is used includes a dispersing agent and a gelling agent. The reinforcing fabric layers can be made from coated fiberglass or alkaline resistant fiberglass.

The process described herein is capable of producing concrete products, including panels in a relatively inexpensive manner and with reinforcing layers on their exterior surfaces. Because the reinforcing layers are substantially exposed and have not been damaged or contaminated with a delaminating material such as oil, decorative coating such as paint can generally be applied to products produced by this process with relative ease.

According to one aspect of the present invention a process for the manufacture of concrete products includes arranging a surface reinforcing layer of porous material in a forming apparatus suitable for the production of a desired concrete product, this material being selected from the group consisting of fabric and moisture-resistant paper, being resistant to alkaline conditions, and having an inner surface thereof coated with a polymer so the applied polymer penetrates the layer of material. A desired amount of a cementitious composition is cast over the layer of material in the forming apparatus. This composition has a consistency that enables it to partially, yet substantially penetrate the layer of material. The amount of this composition that is cast is sufficient that a major portion thereof of least lies on top of the layer of material. Then, one surface of a sheet of porous

material, that is resistant to alkaline conditions and that is selected from the group consisting of fabric and moisture-resistant paper, is coated with polymer so that the applied polymer penetrates the sheet. This coated sheet is placed over an exposed surface of the cast composition so the coated surface lies against the cementitious composition and enables the cementitious composition to penetrate partially the sheet. The so formed concrete product is cured and removed from the forming apparatus.

According to another aspect of a present invention a cement based panel comprises a central core layer of substantial length and width made from a cementitious composition and two surface-reinforcing layers of porous material integrally bonded to the central core layer on opposite sides thereof. The material is selected from the group consisting of fabric and moisture-resistant paper and is alkaline resistant. A suitable polymer material is disposed on and in each of the layers of material at least in a region of each layer that is located adjacent to the central core layer. The cementititous composition which forms a central core layer partially and substantially penetrates each of the surface-reinforcing layers.

In a prefecred embodimont the outer surfaces of both layers of material are coated with a suitable polymer. The porous material of both layers can

comprise glass fiber mat coated with polymer to make it alkaline resistant.

According to a further aspect of the invention a cement based product comprises a central region made from a cementitious composition and forming a major portion of the product, this region having two surfaces of substantial length on opposite sides thereof, and a surface-reinforcing layer of porous material integrally bonded to the central region on each of said two surfaces. This porous material is selected from the group consisting of fabric and moisture-resistant paper and is alkaline resistant. A suitable polymer material is disposed on and in each of the layers of material at least in a region of each layer that is located adjacent to the central region. The cementitious composition which forms a central region partially and substantially penetrates each of the surface-reinforcing layers.

Further features and advantages will become apparent from the following detailed description of preferred embodiments when considered in conjunction with the accompanying drawings.

In the drawings,

Figure 1 is a partially cut away front view of a rectangular panel constructed in accordance with the invention and showing its layered structure;

Figure 2 is cross-sectional view along line II- II of Figure 1, the panel being somewhat enlarged;

Figure 3 is a cross-sectional view of a concrete form used to produce the panel of Figure 1;

Figure 4 is a cross-sectional view similar to Figure 3 but showing a polymer coating being applied to a layer of material placed in the bottom of the form;

Figure 5 is a cross-sectional illustration of the same form showing a cementitious composition cast over the layer of material;

Figure 6 is a side view illustration showing a sheet of porous material being coated with a polymer prior to application of the sheet to the cementitious composition;

Figure 7 is an illustration similar to Figure 5 but showing the coated sheet applied to the cementitious layer;

Figure 8 is a side view showing a cementitious panel constructed in accordance with the invention removed from its form and being coated with polymer on one of its exposed surfaces; and

Figure 9 is a sectional detail showing the manner in which the cementitious composition penetrates the porous material.

Figures 1 and 2 illustrate a cement based panel constructed in accordance with this invention. The panel 10 has a central core layer of substantial length and width made from a cementitious composition.

The central core 12 is covered on both its major surfaces with surface-reinforcing layers 14 and 16 of a porous fabric or moisture-resistant paper integrally bonded to the central core layer on opposites sides thereof. The porous fabric or paper should be composed of an alkaline resistant material so it will not be damaged and eventually destroyed by the alkaline in the cementitious composition. If paper or paperlike material is used, it should be water or molsture resistant as well. Special papers of this type are known in the paper industry. Such papers are available from The Beaver Wood Fiber Co. Ltd. Although the following description will refer to the use of fabric, it will be understood that the use of such paper is also possible.

In order to improve the bond between the fabric layer and the central core and for other reasons explained hereinafter, a suitable polymer material is sprayed on and in each of the fabric layers 14 and 16 at least in regions 18 of each layer that are located adjacent to the central core layer. This polymer material partially penetrates the fabric layer, which preferably comprises finer layers of random fibres, but does not run through the entire thickness of the random fibre fabric. Thus it will be understood that the region 18 extends from the inner surface of each layer 14 and 16 outwardly to point 23 (see Figure 9) located partway through the fabric layer.

In order to provide a secure and durable bond between the fabric layers and the central core, the

cementitious composition, the porous fabric, and the polymer material are selected and applied so as to permit and enable the cementitious composition partially and substantially to penetrate each of the surface-reinforcing layers in the manner illustrated in Figure 9. One significant factor affecting penetration is the consistency of the cementitious composition. Preferably the consistency is selected so as to permit the cementitious composition to penetrate at least one half of the thickness of the fabric layer. A cement mixture that has been found particulary suitable for use in the present invention in the making of relatively thin panels is a mixture that includes one part selected portland cement to three parts of lightweight fine sand plus water, a water reducing admixture and optionally an air entraining admixture. The water to cement ratio in this preferred mixture is not higher than 0.4 while the amount of water reducing admixture is 1% by weight of the amount of cement used. The water reducing admixture should be melamine base type so it will not destroy the air cell structure. In order to produce a light weight panel any commercial air entraining admixture can be used in the composition. A suitable amount of air content for a light weight panel is 15% but, if desired, this can be increased to 30% by volume or even more.

Preferably the long edges of the panel 10 are covered by edge portions of one of the surface-reinforcing layers 14 or 16. These long

edges 13 and 15 are thus protected by the fabric covering and are easier and safer to handle because of this covering.

The surface-reinforcing fabric or mat can be made from thin yarn or filaments so that it has a fine porosity that extends at least half way through the layer of fabric so as to permit the necessary penetration of the cementitious composition. The preferred size of the openings in the mat is from 0.1 to 1.0mm. The fabric layer or mat must have sufficient strength to enable it to provide the required reinforcing characteristics. Preferably the fabric also provides a suitable finished surface to the final product in order to enable a decorative or finish coat, such as paint, to be applied to it. Although a satisfactory product can be produced using polymer fibers which are alkali resistant, the preferred surface-reinforcing fabric employs glass filaments because of their superior strength characteristics, their low elongation under tensile forces and their resistance to temperature increases. The modulus of elasticity of glass fibers is that closest to the modulus of elasticity of concrete. Preferrably the glass filaments in the mat are treated so that they are resistant to mild chemicals and alkaline conditions. Such treatment

can include covering the individual glass filaments with a thin layer of polymer during the manufacture thereof. It has been found by the applicant that a particularly suitable treated glass fiber mat is type 32-1268 AX manufactured by Lydall Inc. These particular glass fiber mats have been used in the past in the production of acoustic panels for buildings. The glass fibers in this particular mat are in fact coated with a polymer material during the mat manufacturing process and therefore the fibers are alkali resistant.

A process for the manufacture of the above described cement based panel 10 will now be described with reference to Figures 3 to 8 of the drawings. In a form 20 having the size of a desired panel 10, a surface-reinforcing layer 14 of porous fabric or water-resistant paper is arranged. This layer covers the entire bottom 22 of the forming apparatus or mould 20 and edge portions 19 on opposite sides extend up the sides of the form 20 as shown. Preferably the layer 14 is sufficiently wide that edge flaps 21 are provided on both sides for use as explained hereinafter. It will be particularly noted that it is not necessary to take any special steps, such as the application of a delaminating coating, prior to placing the layer 14 in place. The layer 14 is self releasing after the panel has been formed.

FIGURES 3-8

The next step is to coat the inner surface 24 of the fabric or paper layer with a suitable polymer 26 that should penetrate the layer. Preferably this coating is applied by means of a spraying device 28. If desired the spraying device can be part of a travelling liquid polymer supply apparatus 30 capable of moving the spraying device across the entire width or length of the form and providing an even coating of the polymer. The amount of polymer is sufficient to cover the fibrous layer completely while at the same time permitting the polymer to penetrate the fabric or paper layer but the amount of polymer should not be so much that it runs through the entire thickness of the layer. One particularly suitable polymer for this purpose is an acrylic resin sold under the brand name Rhoplex B-330 by Rohm and Haas. This polymer coating, which preferably is in addition to to a polymer coating applied to the glass fiber during the manufacture of the mat, provides additional protection for the fibers of the reinforcing layer and results in a stronger bond between the central core 12 and the fabric layer.

One reason for the stronger bond is that the liquid polymer coating will decrease the viscosity of the cementitious composition when it is poured into the form and this in turn permits the composition to penetrate the fabric or paper layer. It should perhaps also be noted that in general the bond between polymer coated glass fibers and a cementitious composition is better than would the case be if the glass fibers were not so coated.

Figure 5 illustrates the casting of a layer 32 of a cementitious composition. The amount of this composition is sufficient to produce a relatively thick central core 12 wherein a major portion of the cementitious composition lies on top of the layer 14. Often at this stage the forming apparatus and its contents are vibrated so as to facilitate the settling of the cementitious composition and its penetration into the layer 14. This casting step should take place before the polymer coating 26 has dried so that the polymer can assist in the penetration of the cementitious composition. The upper surface 34 of the cement mixture should of course be smoothed and shaped to render it suitable

for the application of another layer of porous fabric or paper as described hereinafter. At this time the edge flaps 21 can be folded over and placed on top of the cement layer. These flaps can be pressed into the cementitious composition to achieve a good bond if desired.

There are several known means for vibrating the form 20 and/or its contents during the casting step. For example a vibrating table on which the form 20 is placed can be used or a vibrating tool can be immersed in the cementitious composition.

Figure 6 illustrates a step of coating one surface of a sheet 36 of porous fabric or water-resistant paper with a polymer in a sufficient amount to penetrate the sheet. If desired the sheet 36 can be placed on a suitable supporting surface 38 prior to application of the coating 40. The polymer can be sprayed in substantially the same manner as illustrated in Figure 4, that is with the use of a spraying device 42 that can be supported, if desired, on a travelling supply apparatus 44. This way the entire upper surface 46 of the sheet has an even coating of polymer applied thereto. It will be understood that the sheet 36 is made from a material that is resistant to alkali conditions, such as a mat of

glass fibers coated with a polymer during the manufacture of the mat. As in the step of Figure 4, the preferred polymer applied by the device 42 is an acrylic resin such as Rhoplex E-330 made by Rohm and Haas.

The next step in the process is the placement of the coated sheet 36 over the layer 32 of the cementitious composition so that the coated surface, indicated at 48 in Figure 7 lies adjacent the cementitious layer and helps the cementitious composition to penetrate partially the sheet 36. The sheet 36 is pushed (or embossed) into the core material to assist the penetration of the composition into the fabric layer. Again the profered extent of the penetration is at least half the thickness of the sheet 36. This penetration creates a strong, integral bond between the central core and the reinforcing sheet 36. The pushing of the sheet 36 into the cementitious material can be done in a known fashion by either hand or power tool indicated generally at 50. Preferably during the pushing step the form 20 and/or its contents are vibrated. The

vibrations can be provided by known techniques such as vibrating a table on which the form is placed, vibrating the pushing tools, or vibrating the machine used for pushing. It will be particularly noted that the width of the sheet 36 is less than the width of the panel as shown in Figure 8. Thus each long edge 51 and 53 is positioned a short distance in from the respective panel edge. These edges are adhered to the outer surface of the folded over flaps 21.

After placement of the sheet 36, the so formed panel is cured in the forming apparatus 20 and then removed therefrom. The formed panel 10 is illustrated in Figure 8 with a thickness thereof being exaggerated for sake of illustration. Preferably the panel 10 is again coated with polymer 52 to form surface coatings 53 and 54. The polymer can be applied by means of a spraying device 42 which can if desired be mounted on a travelling supply apparatus 44. The additional coatings 53 and 54 on the exposed surfaces of the layers 14 and 16 provide additional protection against alkali conditions and enables a better bond between the fabric layer and a final decorative or protective coating such as paint.

It will be appreciated that various modifications and changes can be made to the described cement based product and its method of manufacture without departing from the spirit and scope of this invention. For example instead of a single layer of surface-reinforcing fabric or paper on each major surface of the product, several layers of such material placed one over another can be used with the layers being adhered together by the cementitious composition and/or polymer coatings. Cement based products other than panels can be produced with the above described manufacturing method. These non-panel products would generally have an uniform concrete profile and they would be produced in a forming apparatus shaped to produce the required product. It will be understood that products having thicker profiles (compared to a panel product) would be made with a coarser aggregate material with the grade thereof depending upon the particular thickness and the purpose to which the product will be put.

It will be appreciated by those skilled in this art that panels and other cement based products produced according to the present invention will and do have a number advantages over existing building products. For example the preferred panels as described are resistant to increases in temperature as well as being resistant to freezing and thawing. They have both a mechanical and a chemical bond provided between the concrete central core and the reinforcing fabric or paper. Because the method and the product can employ glass fibers for reinforcing purposes, products constructed in accordance with the invention are quite strong and durable. These products are excellent for the application of final coatings such as paint for several reasons including the fact that no delaminating agent is required to form or mold these products. The exposed major surfaces of applicant's products are such that coatings can be applied directly thereto with quite satisfactory results, that is the exposed surfaces are such that cracking and peeling is generally prevented.

The process of the present invention is adaptable to the use of fabric materials other than glass fibers and polymer fibers. Others material that can be used in the reinforcing layers include noncorrosive metals, carbon and graphite. It will be apparent to those skilled in the production of cement based products that other changes and modifications can be made to the above described processes and products of the invention without departing from the spirit and scope of this invention. Accordingly all such modifications and changes that fall within the scope of the appended claims are intended to be part of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for the manufacture of a panel having a concrete core comprising:

a) arranging a surface reinforcing layer of porous material in a forming apparatus, said material selected from the group consisting of fabric and moisture-resistant paper, being resistant to alkali conditions, and having an inner surface thereof coated with a polymer so that the applied polymer penetrates the layer of material;

b) casting a layer of a cementitious composition over said layer of material in said forming apparatus, said composition having a consistency to enable partial yet substantial penetration of said layer of material by said composition, said composition layer being sufficiently thick that a major portion thereof lies on top of said layer of material;

c) coating one surface of a sheet of porous material that is resistant to alkali conditions with polymer so that the applied polymer penetrates said sheet, said sheet selected from the group consisting of fabric and moisture-resistant paper;

d) placing said coated sheet over said layer of cementitious composition so that said coated surface thereof lies adjacent the cementitious layer and enabling the cementitious composition to penetrate partially said sheet; and

a) curing the so formed panel and removing it from said forming appartus.

2. A process according to claim 1 including the added step of coating the exposed surfaces of the porous layer of material and the sheet with a suitable polymer after a removal of the formed panel from said forming apparatus.

3. A process according to claim 2 wherein said layer of material is coated with polymer after it is placed in said forming apparatus.

4. A process according to claim 1, 2 or 3 wherein said layer of material is a glass fiber mat coated with polymer to make it alkali resistant prior to being arranged in said forming apparatus.

5. A process according to claim 3 wherein said polymer applied to said layer of material after placement thereof in said forming apparatus only partially penetrates the layer.

6. A process according to claim 1, 2 or 3 wherein said cementitious composition penetrates at least half of the thickness of said layer of material which has a fine porosity.

7. A process according to claim 1, 2, or 3 wherein said coated sheet of porous material is pushed into said layer of cementitious composition to enable partial and substantial penetration of said sheet.

8. A process according to claim 1, 2 or 3 wherein both said porous layer of material and said sheet of porous material comprise glass fiber mats coated with polymer to make them alkali resistant.

9. A process according to claim 1, 2 or 3 wherein both said porous layer of material and said sheet of porous material comprise fiber mats of relatively fine porosity with openings therein from 0.01 to 1.0 mm wide.

10. A process according to claim 1, 2 or 3 wherein said polymer layer is still wet when the cementitious layer is cast and said coating assists in the penetration of said layer of material by said composition.

11. A process according to claim 2 wherein said forming apparatus is vibrated when said cementitious layer is cast to assist in the penetration of said layer of material.

12. A process according to claim 11 wherein after said layer of cementitious composition is cast, the top surface thereof is then smoothed and shaped for application of said sheet of porous material.

13. A process according to claim 12 wherein said coated sheet of porous material is pushed into said layer of cementitious composition and, during said pushing, said sheet and cementitious composition are vibrated.

14. A process according to claim 1, 2, 3 or 5 wherein both said layer of material and said sheet comprise porous fabric.

15. A process according to claim 1, 2, 3 or 5 wherein both said layer of material and said sheet comprise moisture-resistant paper.

16. A process for the manufacture of concrete products comprising:

a) arranging a surface reinforcing layer of porous material in a forming apparatus suitable for the production of a desired concrete product, said material being selected from the group consisting of fabric and moisture-resistant paper, being resistant to alkali conditions, and having an inner surface thereof coated with a polymer so that the applied polymer penetrates the layer of material;

b) coating a desired amount of cementitious composition over and onto said layer of material in said forming apparatus, said composition having a consistency to enable partial yet substantial penetration of said layer by said composition, said amount of composition cast being sufficient that a major portion thereof at least lies on top of said layer of material;

c) coating one surface of a sheet of porous material that is resistant to alkali conditions with polymer so that the applied polymer penetrates said sheet, said sheet being selected from the group consisting of fabric and moisture-resistant paper;

d) placing said coated sheet over an exposed surface of the cast composition so that said coated surface lies against the cementitious composition and enabling the cementitious composition to penetrate partially said sheet; and

e) curing the so formed concrete product and removing it from said forming apparatus.

17. A process according to claim 16 including the added step of coating the exposed surfaces of the porous layer of material and the sheet with a suitable polymer after removal of the formed concrete product from said forming apparatus.

18. A process according to claim 17 wherein said layer of material is coated with polymer after it is placed in said forming apparatus and said coating is still wet when the cementitious composition is cast.

19. A process according to claim 16, 17 or 18 wherein said layer of material and said sheet comprise moisture-resistant paper.

20. A cement based panel comprising:

a central core layer of substantial length and width made from a cementitious composition;

two surface-reinforcing layers of porous material integrally bonded to said central core layer on opposite sides thereof, said material being selected from the group consisting of fabric and moisture-resistant paper and being alkali resistant; and

a suitable polymer material disposed on and in each of said layers of material at least in a region of each layer that is located adjacent to said central core layer;

wherein the cementitious composition which forms said central core layer partially and substantially penetrates each of said surface-reinforcing layers.

21. A cement based panel according to claim 20 wherein outer surfaces of both layers of material are coated with a suitable polymer.

22. A cement based panel according to claim 20 wherein the porous material of both layers comprises glass fiber mat coated with polymer to make it alkali resistant.

23. A cement based panel according to claim 20, 21 or 22 wherein the cementitious composition penetrates at least half the thickness of each layer of material.

24. A cement based panel according to claim 20, 21 or 22 wherein the porous material forming said two layers consists of a mesh with openings 0.01 to 1.0 mm wide.

25. A cement based panel according to claim 20, 21 or 22 wherein both of said layers of material comprise porous fabric.

26. A cement based panel according to claim 20, 21 or 22 wherein both of said layers of material comprise moisture-resistant paper.

27. A cement based product comprising:

a central region made from a cementitious composition and forming a major portion of said product, said region having two surfaces of substantial length on opposite sides thereof;

a surface-reinforcing layer of porous material integrally bonded to said central region on each of said two surfaces, said porous material being selected from the group consisting of fabric and moisture-resistant paper and being alkali resistant; and

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a suitable polymer material disposed on and in each of the layers of material at least in a region of each layer that is located adjacent to said central region;

wherein the cementitious composition which forms said central region partially and substantially penetrates each of the surface-reinforcing layers.

28. A cement based product according to claim 27 wherein outer surfaces of both layers of material are coated with a suitable polymer.

29. A cement based product according to claim 27 or 28 wherein the porous material comprises glass fiber mat coated with polymer to make it alkali resistant.

30. A cement based product according to claim 27 or 28 wherein said porous material comprises moisture-resistant paper.